Name: ______________________ **Show work needed to justify your answer.** Date: __________

HW: # 6: Math IBSL - Standard 6 - Inverse Functions 5 points

1 Determine algebraically whether the following pairs of functions are inverses.

c $f(x)=\sqrt{3x-2}$ and $g(x)=\frac{x^2}{3}+\frac{2}{3}$

$f(g(x)) = f\left(\frac{x^2}{3}+\frac{2}{3}\right) = \sqrt{3\left(\frac{x^2}{3}+\frac{2}{3}\right)-2}$

$f(g(x)) = \sqrt{x^2+2-2} = \sqrt{x^2} = \boxed{x}$

And

$g(f(x)) = g(\sqrt{3x-2}) = \frac{(\sqrt{3x-2})^2}{3}+\frac{2}{3}$

$g(f(x)) = \frac{3x-2}{3}+\frac{2}{3} = \frac{3x}{3} = \boxed{x}$

$\boxed{\text{yes } f(g(x)) = g(f(x)) = x}$

d $g(x)=-\frac{3}{4}x+5$ and $h(x)=-\frac{4x-20}{3}$

$g(h(x)) = g\left(-\frac{4x-20}{3}\right) = \cancel{-}\frac{3}{4}\left(\cancel{-}\frac{4x-20}{3}\right)+5$

$g(h(x)) = \frac{4x-20}{4}+5 = x-5+5 = \boxed{x}$

$h(g(x)) = h\left(-\frac{3}{4}x+5\right) = -\frac{4\left(-\frac{3}{4}x+5\right)-20}{3}$

$h(g(x)) = \cancel{-}\left[\frac{\cancel{-}3x\cancel{+20}\cancel{-20}}{3}\right] = \boxed{x}$

$\boxed{\text{yes. } g(h(x)) = h(g(x)) = x}$

2 Find the x-intercept and y-intercepts of the line $y=-4x+2$. Explain how these points can help you to graph the inverse.

x-INT (y=0)

$0=-4x+2$

$-2=-4x$

$x=\frac{1}{2}$

$(\frac{1}{2},0)$

y-INT (x=0)

$y=-4(0)+2$

$y=2$

$(0,2)$

* inverse means switch x & y. graph of inverse goes through $(0,\frac{1}{2})$ and $(2,0)$

6 If $f(x)=2x-5$:

a solve $f(x)=11$

b find $f^{-1}(x)$

c find $f^{-1}(11)$.

d What do you notice about your answers to parts **a** and **c**?

e Create a general rule to explain your answer for part **d**.

(a) $11=2x-5$

$16=2x$

$\boxed{x=8}$

b) $y=2x-5$

$x=2y-5$

$x+5=2y$

$\boxed{f^{-1}(x)=\frac{x+5}{2}}$

c) $f^{-1}(11) = \frac{11+5}{2} = \boxed{8}$

d) SAME Answer.

e) (x,y) for $f(x)$ = (y,x) for $f^{-1}(x)$

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HW: # 6: Math IBSL - Standard 6 - Inverse Functions 5 points

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2 **a** Show that $y = 3 - x$ is a self-inverse function.

a) $f(f(x)) = f(3-x) = 3-(3-x)$

$f(f(x)) = 3-3+x = \boxed{x}$

b Show that $y = -2 - x$ is a self-inverse function.

b) $f(f(x)) = f(-2-x) = -2-(-2-x)$

$f(f(x)) = -2+2+x = \boxed{x}$

d Write a generalization from your answers in parts **a–c.**

$f(x) = n - x$ is its own inverse for all $n \in \mathbb{R}$

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3 Show that $f(x) = \dfrac{-x-2}{5x+1}$ is a self-inverse function.

$$f(f(x)) = f\left(\frac{-x-2}{5x+1}\right) = \frac{-\left(\frac{-x-2}{5x+1}\right) - 2}{5\left(\frac{-x-2}{5x+1}\right) + 1} = \frac{\frac{x+2}{5x+1} - \left[\frac{10x+2}{5x+1}\right]}{\frac{-5x-10}{5x+1} + \left[\frac{5x+1}{5x+1}\right]}$$

$$f(f(x)) = \frac{\frac{-9x}{5x+1}}{\frac{-9}{5x+1}} = \left(\frac{\cancel{-9}x}{\cancel{5x+1}}\right)\left(\frac{\cancel{5x+1}}{\cancel{-9}}\right) = \boxed{x}$$

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4 Find the value of m such that $g(x) = \dfrac{2x-4}{x+m}$ is a self-inverse function.

$$g(g(x)) = g\left(\frac{2x-4}{x+m}\right) = \frac{2\left(\frac{2x-4}{x+m}\right) - \frac{4}{1}\left(\frac{x+m}{x+m}\right)}{\left(\frac{2x-4}{x+m}\right) + \frac{m}{1}\left(\frac{x+m}{x+m}\right)} = \frac{\left(\frac{4x-8-\cancel{4x}-4m}{x+m}\right)}{\frac{2x-4+mx+m^2}{x+m}}$$

Then...

$$\frac{-8-4m}{2x-4+mx+m^2} = x \rightarrow -8-4m = x(2x-4+mx+m^2)$$

$$-8-4m = 2x^2 - 4x + mx^2 + m^2x$$

$$-8-4m = (2+m)x^2 - 4x + m^2x$$

* Since x^2 does not appear on left

Then → $m+2=0$

$\boxed{m=-2}$